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CANADA-ONTARIO AGREEMENT  
RESPECTING  
GREAT LAKES WATER QUALITY

ANNUAL REPORT  
1985-1986

Board of Review  
December 1986



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**OF ONTARIO**



LETTER OF TRANSMITTAL

December 1986

The Honourable Tom McMillan  
Minister, Environment Canada

The Honourable James Bradley  
Minister, Ontario Ministry of the Environment

The Honourable Tom Siddon  
Minister, Fisheries and Oceans

The Honourable Vincent Kerrio  
Minister, Ontario Ministry of Natural Resources

The Honourable David Peterson  
Premier of Ontario and  
Minister, Ontario Ministry of Intergovernmental Affairs

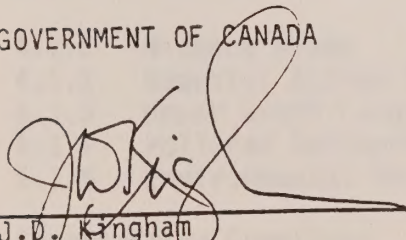
The Honourable John Wise  
Minister, Agriculture Canada

The Honourable Jack Riddell  
Minister, Ontario Ministry of Agriculture and Food

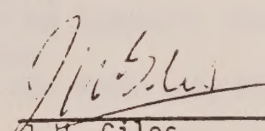
Gentlemen:

In accordance with Section 2.(v) of Schedule F of the Canada-Ontario Agreement Respecting Great Lakes Water Quality, signed on March 6, 1986, we submit herewith the Annual Report under this Agreement for the fiscal year 1985/86.

GOVERNMENT OF CANADA

  
J.D. Kingham  
Co-chairman  
Environment Canada

PROVINCE OF ONTARIO

  
J.W. Giles  
Co-chairman  
Ontario Ministry of the Environment

Canada-Ontario Agreement Respecting Great Lakes Water Quality

L'Accord Canada-Ontario relatif à la qualité de l'eau dans les Grands Lacs



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## 1.0 INTRODUCTION

Shared responsibilities for environmental quality in Canada between the two senior levels of government call for intense cooperative efforts. Programs must be delivered in a well-integrated and fully cooperative fashion to minimize over-all government expenditures whilst maximizing the effective delivery of Federal and Provincial environmental quality programs. To provide for a well coordinated effort in the Great Lakes area, Canada and Ontario have concluded a federal-provincial agreement respecting Great Lakes Water Quality.

### 1.1 The Agreement

The Canada-Ontario Agreement respecting Great Lakes Water Quality (COA) signed on March 6, 1986 replaces the Canada-Ontario Agreement of July 12, 1982. It again reflects the Canada-United States Great Lakes Water Quality Agreement of 1978, and while continuing the terms of the earlier COA agreements, places greater emphasis on the control of toxic substances, the development of remedial action plans, and provides for the implementation of the Canadian Phosphorus Management Plan.

### 1.2 Strategic Objective

The basic philosophical change of the 1986 Canada-Ontario Agreement is the agreement on a strategic objective. Both Canada and Ontario agree to "restore and protect the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem as a multi-use resource whose base provides the setting and foundation for social development and economic investment".

### 1.3 Purpose

The purpose of the 1986 Canada-Ontario Agreement is to renew and strengthen cooperation between Canada and Ontario in meeting the obligations assumed by Canada under the 1978 Canada-U.S. Agreement. It is also to provide for cost sharing of specific programs which the Province will undertake to assist Canada in meeting these obligations.

### 1.4 Obligations

The obligations assumed by the governments under the Agreement require the development and implementation of programs and measures within their respective areas of legislative responsibility to maintain or improve water quality of the boundary waters. In order to achieve this purpose, maximum efforts will be made to develop a better understanding of the Great Lakes Basin Ecosystem and to protect it by the elimination



or reduction, to the maximum extent practicable, of pollutants discharged to the system.

## 2.0 THE 1982 CANADA-ONTARIO AGREEMENT RESPECTING GREAT LAKES WATER QUALITY

### 2.1 Policy and Program Management

The former Canada-Ontario Agreement (1982) was founded on the 1978 Canada-U.S. Great Lakes Water Quality Agreement. Events unfolding after negotiations of this Agreement have been taken into account in the formulation of the 1986 Canada-Ontario Agreement. The major changes in the new Agreement are discussed below:

#### a) Sewerage Facilities Construction Program

Under the 1972 and 1978 Canada-U.S. GLWQA (article VI, Section 1(a)) Canada was obligated to aid Ontario and its municipalities in the upgrading or construction of sewerage treatment facilities, to meet the effluent objective of 1 mg of phosphorus/litre of discharge.

The 1982 COA provided for a one-time contribution of \$65.0 million to Ontario for the completion of this program.

Due to labour strikes, equipment delivery delays and other factors beyond the control of the Federal and Provincial governments, municipalities were unable to utilize the full allocation of funds.

The new COA extends Schedule G by rolling-over and reprofiling lapsed federal funds to dispense the Federal commitment to the program.

#### b) Nearshore Surveillance, Research and Other Activities

The \$2.4 million funds contributed equally by Canada and Ontario to COA had not been reviewed since the 1976 COA. The new COA increases each government's contribution to \$1.6 million for a total program of \$3.2 million.

#### c) Phosphorus Management Plan

On October 16, 1983, Canada and the United States formally agreed to the Phosphorus Load Reduction Supplement to Annex 3 of the Great Lakes Water Quality Agreement of 1978. In compliance with Annex 3, the COA Board of Review established a Federal/Provincial





Phosphorus Task Force in order to develop a Canadian Phosphorus Load Reduction Plan for the Great Lakes. This plan was developed during FY 1984-1985.

In order to implement this plan, the new COA provides for the federal and provincial governments to equally contribute for in-stream monitoring and evaluation of non-point phosphorus control programs in the Lake Erie Basin as identified in the Canadian Phosphorus Load Reduction Plan.

The new COA also provides for the federal and provincial governments to fund on a 50-50 basis, a study to obtain technical assessments of related facilities within the lower Great Lakes in order to determine the existing design capacities and the additional costs required to lower the total phosphorus load flow to less than 1.0 mg/l.

d) Areas of Concern

In 1981, the Water Quality Board (WQB) of the International Joint Commission (IJC) identified and described environmental degradation in 39 site-specific areas of concern in the Great Lakes Basin of which 17 are within the Canadian Great Lakes Basin and the Connecting Channels.

Although remedial measures have been put in place to correct some of the ecosystem degradation in some of these areas and studies are ongoing in others, few of the identified problems have been corrected.

The new COA establishes a joint federal/ provincial program to address these areas of concern.

e) Composition of COA Board of Review

Historically, the composition of the COA Board of Review has included 6 members - three appointed by Canada and three appointed by Ontario.

With the development of the Canadian Phosphorus Load Reduction Plan for the Great Lakes it has become apparent that the agricultural agencies are an important partner in meeting the phosphorus load reductions specified in Annex 3.

The new COA calls for the expansion of the membership of the COA Board of Review to 10 to include the Federal





Department of Agriculture and the Provincial Ministry  
of Agriculture and Food.

f) Length of COA

The 1982 COA was a three year agreement.

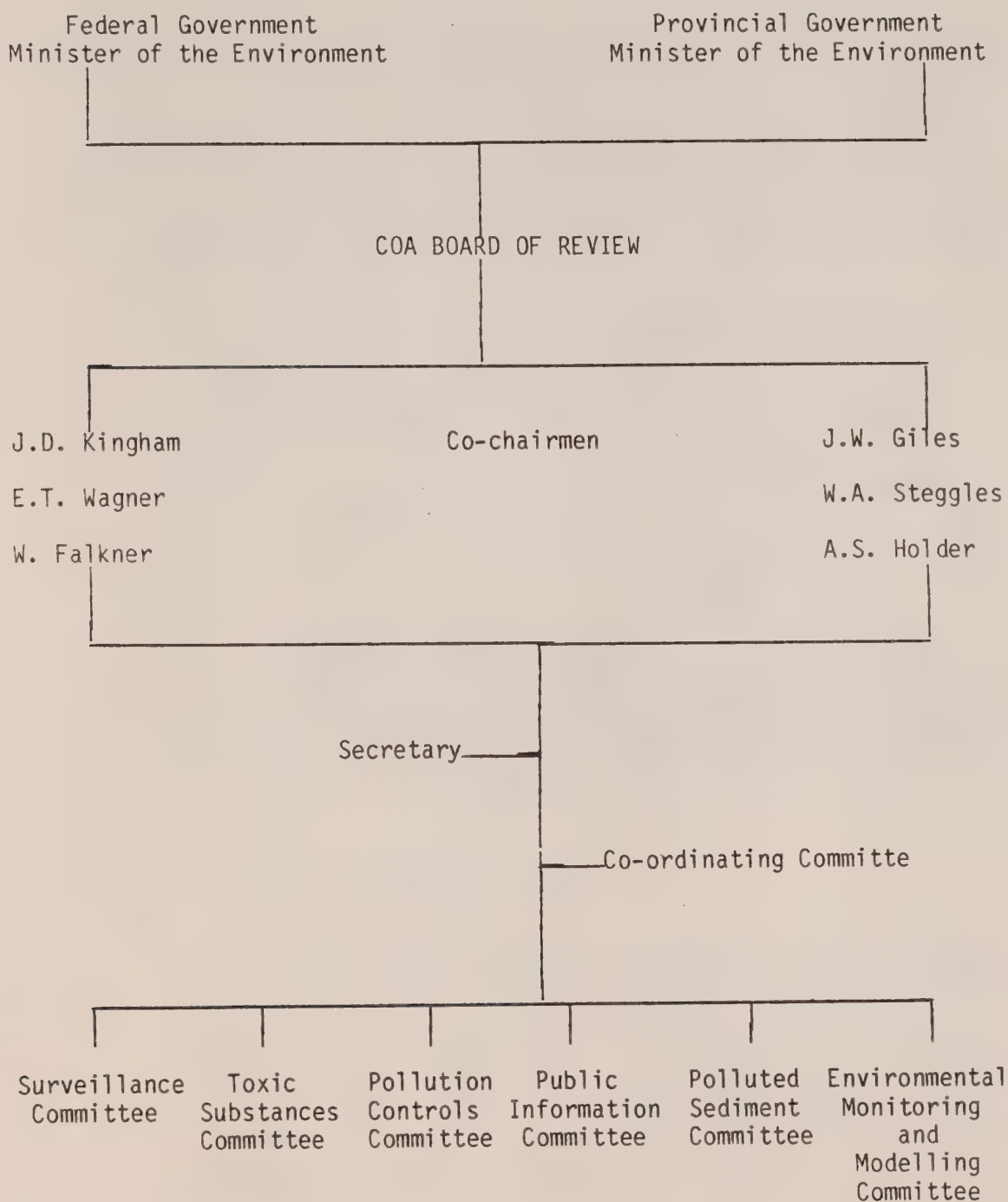
If there are significant amendments to the Canada/U.S. Agreement following the review called for in Article X, paragraph (e) of that Agreement, it will be beyond 1988 when these amendments come into force. Also, the full implementation of the Canadian Phosphorus Load Reduction Plan will take until March 31, 1991. Consequently, the new COA is for a period of 6 fiscal years.

The recognition and acceptance of the ecological approach to water quality problems in the 1978 international agreement and the 1982 and 1986 COAs demand multidisciplinary consideration of issues and their interactive elements within an integrated management concept. It is essential that COA Board of Review and Committee members be cognizant of all activities pertinent to Great Lakes problems to enable them to assess the adequacy of programs, and to develop and recommend new policies and programs to resolve existing and emerging problems. Even though the COA Board of Review may not be actively engaged in and responsible for all water and related programs in the Great Lakes Basin, it must be able to approach issues from a "total management" perspective. Of particular concern are those programs undertaken by governments to meet requests from the International Joint Commission, to ensure compatibility with governmental initiatives, and to ratify all information forwarded to the IJC to fulfill these requests. Federal-Provincial cooperation is now effected not only through the cost sharing of specific programs but also through work sharing, information transfer and the coordination of pertinent departmental programs.

The COA Board of Review serves as a focus for Canadian Great Lakes environmental policy review, not only as it pertains to Federal and Provincial perspectives, but also as it relates to those of the U.S. Federal and State Governments and the International Joint Commission. The Board is in a position to influence the extent and direction of progress at the governmental level in Canada, and to a minor extent in the United States. In this regard the COA has proved useful in consolidating a Canadian position presented to the U.S. in such transboundary issues as the Niagara River and the St. Clair River.



## 2.2 COA Organization







### 3.0 COA BOARD AND COMMITTEE MEMBERSHIP AND FUNCTIONS

#### 3.1 Board of Review

The Board of Review consists of 10 members, 5 each from the Federal and the Provincial governments. The Federal membership consists of two senior staff representatives from the Department of the Environment - Ontario Region, and one from the Department of Fisheries and Oceans - Ontario Region with two additional members to be appointed. The provincial membership consists of two senior staff representatives from the Ontario Ministry of the Environment, and one from the Ministry of Natural Resources with two additional members to be appointed. The members as of March 31, 1986 were:

Government of Canada

J.D. Kingham  
Department of Environment

E.T. Wagner  
Department of Environment

W. Falkner  
Department of Fisheries  
and Oceans

Government of Ontario

J.W. Giles  
Ministry of Environment

W.A. Steggles  
Ministry of Environment

A.S. Holder  
Ministry of Natural  
Resources

The Board is charged with maintaining a current knowledge of national and provincial policies and programs pertinent to Great Lakes Water Quality, formulating recommendations to the Parties to the Agreement with respect to the implementation of COA, monitoring the activities undertaken, and reporting annually.

#### 3.2 COA Committees

##### 3.2.1 Coordinating Committee

The Coordinating Committee consists of fourteen members, viz., Federal and Provincial co-chairmen plus two members from each of the other COA committees (the co-chairman of the six other committees). The co-chairmen of the Coordinating Committee are also members of the Water Quality Programs Committee of the IJC Great Lakes Water Quality Board. Thus, the Coordinating Committee is fully informed of the initiatives proposed by the IJC Water Quality Board which influence the Federal and Provincial programs and policies developed to preserve and enhance Great Lakes water quality.





The Coordinating Committee reports to the Board of Review on these initiatives and under its direction advises other COA committees in fulfilling COA requirements. It also reports jointly with the other committees on significant findings and problems which may affect Canada and Ontario in meeting their commitment to the Canada-U.S. Great Lakes Water Quality Agreement.

### 3.2.2 Surveillance Committee

The Surveillance Committee is co-chaired by the Federal and Provincial members responsible for Great Lakes surveillance - the Manager of the Surveillance Program, Inland Waters Directorate, Environment Canada, and the Manager of the Great Lakes Section, Water Resources Branch, Environment Ontario. Other members of the Committee represent Department and Ministry Branches and Sections directly involved in Great Lakes water quality and monitoring. That part of the program undertaken by provincial agencies is carried out primarily in the nearshore waters of the Great Lakes and their connecting channels. The work of Federal agencies is devoted to open water surveillance and fisheries research. The object is to assess the state of and trends in overall health of the lakes through the measurement of physical, chemical and biological parameters and the assessment of numerous hazardous polluting and toxic substances.

The Committee is required to review annually the objectives, scope, expected output and associated costs of surveillance programs proposed by Federal and Provincial agencies, and make recommendations for approval and funding under the Agreement. Emphasis is given to greater coordination of cost-effective programs, and reports on the progress being achieved, including new problems and findings of the surveillance program.

### 3.2.3 Toxic Substances Committee

The Toxic Substances Committee is co-chaired by the Scientific Advisor to the Director General, Environment Canada, Ontario Region and the Manager of the Aquatic Contaminants Section of the Ontario Ministry of the Environment. Members of the Committee are drawn from all agencies having to do with toxic substances to ensure a wide cross-section of expertise. This includes all aspects of the detection, quantification, effect, and control of toxic and hazardous polluting substances.



The Committee reports to the Board of Review on those Federal and Provincial programs and activities relevant to hazardous polluting substances and persistent toxic substances. It identifies priority areas, issues of concern, evaluates the programs of both Parties, and makes an annual report thereon.

To date, emphasis has been placed on providing for an effective exchange of information among the scientists and managers involved.

#### 3.2.4 Pollution Controls Committee

The Pollution Controls Committee is comprised of the Manager, Pollution Control Division of the Federal Environmental Protection Service, Ontario Region, and the Assistant Director of the Provincial Water Resources Branch. The Committee is charged with monitoring all activities, except for surveillance and toxic substances, undertaken to fulfill the requirements under "Programs and Other Measures", Article VI of the 1978 Canada-U.S. Great Lakes Water Quality Agreement. Under the direction of the Board of Review, it is empowered to establish work groups/task forces to consider specific issues and prepare reports.

In general, the Committee monitors activities, including research, relevant to: pollution from municipal and industrial sources, including pollution abatement and compliance; eutrophication; pollution from agriculture, forestry and other land use activities; pollution from shipping, dredging, and other land use activities; and contingency planning. Reports on significant findings and problems are required as they occur. An annual review is also required by the Board of Review to chart the progress of various control and restoration programs.

#### 3.2.5 Public Information Committee

This Committee is composed of representatives from the Ontario Ministry of the Environment, Environment Canada-Ontario Region, and the Department of Fisheries and Oceans-Ontario Region. The prime goal of the Public Information Committee is to provide information to the public on the purpose and achievements of COA, and to explain, in common terms, this unique Agreement which provides for Federal-Provincial cooperation to improve Great Lakes water quality. It is also incumbent upon the Committee to keep the Board of Review informed on the wide spectrum of information released on Great Lakes environmental issues.





The Committee arranges publicity for COA activities and develops resource materials to promote better public understanding of Great Lakes issues, and COA involvement in these issues.

### 3.2.6 Polluted Sediment Committee

The Polluted Sediment Committee is co-chaired by the Sediments Coordinator, Aquatic Contaminants Section, Ontario Ministry of the Environment and the Senior Environmental Design Officer, Federal Environmental Protection Service, Environment Canada. Support to the Committee is provided from all agencies having to do with polluted sediments on an as required basis.

The general mandate of the committee is described as follows:

- ° Outline the major components of the Polluted Sediment Program and to identify specific tasks requiring immediate and future action.
- ° Facilitate the rapid and efficient completion of these various tasks while ensuring adequate scientific and technical input and review.
- ° Co-ordinate and monitor the progress of the various program components so as to ensure consistent conclusions and recommendations by both federal and provincial agencies.

### 3.2.7 Environmental Monitoring and Modelling Committee

The Environmental Monitoring and Modelling Committee was established to assess the effectiveness of federal and provincial programs to reduce phosphorus loadings to the Great Lakes in accordance with the Canadian Federal/Provincial Phosphorus Load Reduction Plan for the Great Lakes and the Phosphorus Load Reduction Supplement to Annex 3 of the 1978 Agreement between Canada and the United States of America on Great Lakes Water Quality. The committee is co-chaired by the Ontario Ministry of the Environment and the Federal Department of Environment with representation from Agriculture Canada, the Ontario Ministry of Agriculture and Food and the Ontario Ministry of Natural Resources. Technical support is provided by a sub-committee consisting of 5 members each from Canada and Ontario and co-chaired by the Ontario Ministry of the Environment and the Federal Department of Environment.

Generally, the responsibilities of the committee include the following:



- ° Develop an annual work plan and budget.
- ° Obtain and interpret tributary phosphorus loading data for major rivers tributary to Lake Erie.
- ° Conduct phosphorus load monitoring activities on the Pilot Agricultural Watersheds selected for intensive implementation of the Soil and Water Conservation Program.
- ° Collect and interpret phosphorus data required for compliance monitoring related to municipal and industrial point sources.
- ° Assess the effectiveness of the implementation of the Phosphorus Management Plan and report annually to the COA Board of Review on its status.
- ° Participate in communications plan developed as part of the Southwestern Ontario Soil and Water Enhancement Program.

#### 4.0 1985/86 FISCAL YEAR ACTIVITIES

##### 4.1 Board of Review

The Board of Review held seven meetings during the fiscal year. In addition to the on-going administration of Board and Committee affairs, the Board was involved with the following major issues:

###### 4.1.1. Niagara River:

- a) Document entitled "Drinking Water in the Niagara River" was vetted by the Board of Review and recommended for release by the federal and provincial environmental ministries. This document was released in September 1985.
- b) The Board of Review maintained a watching brief on bilateral discussions regarding the Niagara River.

###### 4.1.2. Remedial Action Plans (RAPS):

At its 65th Meeting held on May 14, 1985, the Board of Review approved a strategy for the development of Remedial Action Plans. During subsequent meetings, the Board provided comments and direction on the development of these RAPS with particular attention given to the Remedial Action Plan for Collingwood Harbour. This plan was developed as a model. Other RAPS prepared for Board





review included:

- Spanish River
- Wheatley Harbour
- St. Mary's River
- Niagara River
- St. Clair River

4.1.3. Upper Great Lakes Connecting Channels Study:

The Board of Review monitored the progress of this binational study.

4.1.4. Polluted Sediment Committee:

At its 66th Meeting held on July 26, 1985, the Board of Review approved the establishment of the Polluted Sediment Committee.

4.1.5. Environmental Monitoring and Modelling Committee:

At its 66th Meeting held on July 26, 1985, the Board approved the establishment of the Environmental Monitoring and Modelling Committee. Terms of reference for this committee were approved at the Board's 69th Meeting held on January 31, 1986.

4.2 Co-ordinating Committee

The Coordinating Committee in its role as the administrative arm of the Board of Review, coordinated the development of the 1985/86 work plan and budgets of the COA Committees. A review of current programs and priorities were made with the objectives of improving information plans from the Board of Review to the International Joint Commission's Water Quality Board, and the development of remedial action plans. Priority attention was also given to the following issues: toxics-related assessment and control programs; pollution from shipping; contingency planning; surveillance programs; dredging program recommendations of the Water Quality Board; and implementation of the Canadian Federal/Provincial Phosphorus Management Plan.

4.3 Surveillance Committee

The Surveillance Committee reported to the Board of Review on those programs and activities undertaken by Ontario and Canada pursuant to the requirements of Schedules A and D of the 1986 Canada-Ontario Agreement respecting Great Lakes Water Quality. The work undertaken by the Federal and Provincial programs are reflected in Tables 1 and 2 respectively.



#### 4.3.1 FEDERAL PROGRAM

Canada's prime responsibility under the Canada-U.S. Great Lakes Water Agreement is the conduct of open lake surveillance complementing that undertaken by U.S. agencies. The federal Department of the Environment is responsible for the monitoring of conventional parameters and contaminants in the waters of the open lakes. The Department of Fisheries and Oceans, in concert with the Ontario Ministry of Natural Resources, contributes to the International Open Lakes Fish Contaminants Program which is coordinated with similar programs conducted by the U.S. EPA and Fish and Wildlife Service. Table 1 presents the surveillance and related research programs carried out by the federal government in 1985/86.

Information based on these activities is published in federal government reports and in scientific papers. Pertinent results from these studies are also summarized and submitted to the IJC Water Quality Board for inclusion in its Annual Report to the International Joint Commission. A brief overview of the surveillance activities is presented below.

##### Environment Canada-Inland Waters Directorate, Ontario Region

##### Lake Ontario

Two spring and three summer surveillance cruises were completed on Lake Ontario by the Canadian research ship CSS Limnos. The National Water Quality Laboratory provided shipboard analytical support and carried out shore laboratory analysis for all cruises.

Comprehensive analysis of water quality data for the years 1967 to 1984 was completed. The findings were reported in the following three major reports: "Response of Lake Ontario to Reductions in Phosphorus Load 1967-1982"; "Vertical and Horizontal Distribution of Nutrients and Particulate Organic Matter in Lake Ontario, 1981-1982"; and "Determination of Water Quality Zonation in Lake Ontario Using Multivariate Techniques". A 1984 status report was prepared on the water quality of the open waters of Lake Ontario and a report entitled "Organochlorine Contaminants in Ambient Waters of Lake Ontario" was prepared for publication in the the IWD Report Series. In addition, work continued on the Lake Ontario Intensive Report, which is to be submitted to the Surveillance Work Group of the IJC Water Quality Board in 1986.





TABLE 1

FEDERAL SURVEILLANCE AND RELATED RESEARCH PROJECTS  
1985/86

A. INLAND WATERS DIRECTORATE - ONTARIO REGION

1. Lake Superior Open Lake Surveillance
2. Lower Lakes Surveillance
3. Niagara River Water Quality Monitoring
4. St. Lawrence River Water Quality Monitoring
5. Continuous Sampling of Organic Contaminants in the Niagara River
6. Organics in Atmospheric Precipitation
7. Precipitation Chemistry Network
8. Upgrading of Niagara River Water Quality Stations for Continuous Sample Collection
9. Lake Huron Surveillance

B. CANADIAN WILDLIFE SERVICE

1. Contaminants in Herring Gull Eggs
2. Deformities in Aquatic Birds

C. GREAT LAKES FISHERIES RESEARCH BRANCH - DFO

1. Biological Index Monitoring
2. Fish Health Assessment
3. Contaminants Surveillance
4. Hamilton Harbour Rehabilitation
5. Biological Tissue Archive
6. Great Lakes Phytoplankton - Overview
7. Bioassessment of Sediments

D. NATIONAL WATER RESEARCH INSTITUTE

1. Upper Great Lakes Connecting Channels Circulation Patterns in Lake St. Clair
2. Storm Surge Simulation on Lake Erie and Lake St. Clair
3. Toxic Contaminant Model for the Upper Great Lakes Connecting Channels
4. Eutrophication Model for the Upper Great Lakes Connecting Channels
5. Sedimentology: Lake Erie/Lake St. Clair
6. Urban Run-off: Upper Great Lakes Connecting Channels



TABLE 1 (Cont'd)

7. Organic Contaminants in the Great Lakes Basin
8. Chlorinated Hydrocarbons in Sediments and Biota of the Great Lakes
9. Accumulation/Toxicity of Organic Contaminants by Yeast/Fungi (Eukaryotes)
10. Speciation/Concentration and Pathways of Alkyllead Compounds in the Environment
11. Dynamics of Sediments - Toronto Harbour
12. WHO Collaborating Centre on Surface and Groundwater Water Quality
13. Assessment of Niagara River Water Quality
14. GEMS/UNEP - Global Water Quality Data Management
15. Federal/Provincial Quality Assurance Program
16. IJC Quality Control (Interlab Studies)
17. WQB and PPWB Quality Assurance Program
18. Quality Assurance Program - Dredging
19. Certified Reference Materials, Preservation and National QC Study
20. Quality Assurance and CRM Development for Organics
21. Organic Methods Development
22. Preservation of Organics
23. CCIW Data Archiving





### Lake Huron

Spring and summer open lake water quality surveillance cruises were conducted on Lake Huron. Samples were collected at 90 stations for the parameters identified in the IJC Lake Huron Surveillance Plan. Trace metal samples, both filtered and total, were collected at 24 stations as part of the spring cruise.

Results of the 1984 sampling effort for organic contaminants in Lake Huron centrifuged water samples were summarized.

### Lake Superior

One spring cruise, sampling 60 stations, was carried out on Lake Superior to document changes in water quality observed between 1973 and 1983. Trace metal samples were collected at 20 stations as part of this cruise.

Draft reports detailing the water quality of Lake Superior as measured on the surveillance cruises in 1983 and the concentration of organic contaminants in water in Lake Superior in 1983 were prepared.

### Niagara River Toxic Contaminants

The Niagara River Toxics Committee (NRTC) report released in November, 1984 assessed toxic contaminants and their sources in the Niagara River, reviewed toxic chemical control programs, recommended improvements to those programs and proposed a long term monitoring program. In late 1985, a Niagara River Monitoring Management Committee was formed with the Director, IWD, Ontario Region as chairman to develop a monitoring plan based on the Report's recommendation. The committee has three objectives: the assessment of the degree of compliance with jurisdictional control requirements; the assessment of trends to determine response to control measures, the effectiveness of those measures and emerging problems; and the identification of sources of toxic substances inputs to the Niagara River.

In addition to supporting the work of the Management Committee, IWD, Ontario Region maintained its ongoing surveillance and monitoring activities on the Niagara River.

The NRTC, 1984 report, recommended that 57 Group I chemicals of concern should be monitored in the Niagara River and that differential loading estimates of each of



these chemicals should be determined. In response to this recommendation, a contract was issued in late 1984 to Zenon Environmental Inc. for the analyses of both centrifuged water and suspended sediment samples collected biweekly at both the Niagara-on-the-Lake and Fort Erie stations for all 57 chemicals in the Group I list. These included several groups, volatiles (water only), chlorophenols, organochlorine pesticides and PCB's, polynuclear aromatic hydrocarbons, dioxins and furans, phthalates and chlorobenzenes. A status report, "Toxic Chemical Monitoring and the Determination of Differential Loadings to the Niagara River" summarizing the results for the period Dec. 1984 - March 1985 was completed in June 1985. A report, entitled "Evidence of Contaminant Loading to Lake Ontario from the Niagara River" was published in the Canadian Journal of Fisheries and Aquatic Sciences, July 1985. This paper was prepared by National Water Research Institute (NWRI) and IWD staff using several different statistical procedures to show changes in contaminant concentrations from the Upper to the Lower Niagara River. Data used in the preparation of the paper was provided by WQB-OR and the Ontario Ministry of Environment.

#### Large Volume Extraction Systems

A system for sampling organic contaminants in water and suspended sediment on a continuous basis was designed and set up in conjunction with National Water Research Institute (NWRI) at the WQB monitoring station in Niagara-on-the-Lake. Field testing of the system commenced in December 1985, and will be continued in 1986. A report detailing the design and test results of the large volume Aqueous Phase Liquid-liquid Extractor (APLE) was published in November 1985.

#### St. Clair River Toxic Contaminants

In July of 1984, Canadian and U.S. environmental and resource agencies agreed to undertake a coordinated multi-year environmental quality study of the St. Mary's, St. Clair, and Detroit Rivers and Lake St. Clair. To direct the study, an Upper Great Lakes Connecting Channels Study Management Committee was formed. The Director, IWD, Ontario Region is a member of the Committee while other IWD staff support the activities of the many work groups involved in the study. During 1985, IWD, Ontario Region staff participated in the development of the study plan and carried out preliminary field investigations.





Four water quality surveys, designed to determine ambient levels of contaminants in the major confluences of the St. Clair River, were carried out over the period August to October. Preliminary findings indicated that flow patterns of industrial effluents containing contaminants such as hexachlorobenzene, hexachlorobutadiene and pentachlorobenzene appeared to be confined to the Canadian shoreline and the Chanel Ecarte and the South Channel. A detailed report will be completed in 1986. A draft report, "Review of WQB-OR Sampling on the St. Clair River 1967-83" detailing the water quality at the WQB sampling sites at Port Lambton and Sarnia was completed.

#### Niagara River

During May 1985, WQB-OR marked the tenth anniversary of collecting daily water quality samples at the Niagara-on-the-Lake station. Automatic water samplers at Niagara-on-the-Lake and Fort Erie collected daily samples for nutrient determinations and weekly samples for major ion, trace metal and radioactivity analysis to determine chemical loadings from Lake Erie and to Lake Ontario. Results of these analyses were provided annually to the IJC for inclusion in the Great Lakes Water Quality Report. A draft report, "Recent Trends in Water Quality of the Niagara River" was completed. This report summarized water quality trends observed at the Niagara-on-the-Lake station during the 1976-83 period.

A new daily water quality sampler, designed to maintain the integrity of the daily samples, was assembled and lab tested in co-operation with Mantec (National Water Research Institute) staff. The sampler will be installed at the Niagara River stations in early 1986.

#### St. Lawrence River

Water quality monitoring continued in the St. Lawrence River. Daily samples for nutrients, weekly samples for major ions, trace metals and radioactivity were collected with an automatic water sampler at the Wolfe Island station to determine chemical exit loadings from Lake Ontario. Monthly samples of water and suspended sediments were also collected and analysed for trace organic contaminants. Results of these analyses are being provided annually to the IJC for inclusion in the Great Lakes Water Quality Report. Two reports, "Water Quality at the Inlet to the St. Lawrence River, 1977-83" detailing changes in the water quality at the Wolfe Island station and "Contamination in the Bottom Sediments of the St. Lawrence River in June



1975" showing levels of bottom sediment contaminant determined by a survey carried out between Kingston and Cornwall in 1975 were prepared for publication in the IWD Report Series. Two draft reports, "Evaluation of the Nutrient Forms Measured at Wolfe Island" and "Trace Organic Contaminants in the Bottom and Suspended Sediments of the St. Lawrence River" were prepared.

#### Atmospheric Loading

WQB continued to operate a network of 16 precipitation stations established as part of the IJC Great Lakes International Surveillance Plan to measure atmospheric loadings in the Great Lakes Basin. A report, "Lake Superior Wet Deposition, 1983", submitted to the IJC Lake Superior Task Force and presented at The International Association for Great Lakes Research Conference in Milwaukee in May showed that atmospheric wet deposition of sulphate was 153 thousand tonnes per year, about 22% of the total load, while nitrate accounted for 55% (19000 tonnes) of the total load. Wet deposition of phosphorus was 460 tonnes per year, and 13% of the total load. These figures were consistent with calculated loading determined using a simple mass balance model.

WQB began operating a network of four organic precipitation stations, one in each lake basin, (Sibley Park, Manitoulin Island, Pelee Island, and Wolfe Island) to sample wet precipitation for levels of trace organic contaminants in the Great Lakes basin. Based on two years of data from the Lake Superior Basin, wet precipitation contained significant quantities of BHC's, PCB's, methoxychlor and dieldrin. A detailed report, "Organochlorine Pesticides and Polychlorinated Biphenyls in Lake Superior Precipitation" was submitted to the IJC Lake Superior Task Force.

In a separate study, WQB, jointly with the National Water Research Institute (NWRI), operated a ten station precipitation network, using XAD resin as an in situ extraction medium, to characterize the areal distribution of organic contaminants within the Great Lakes Basin.

#### Canadian Wildlife Service

Field work in 1985/86 was severely restricted as a result of major cutbacks imposed by the government on the Canadian Wildlife Service program. Consequently only two major ongoing programs were continued. CWS continued measuring trends in contaminant residues in Herring Gull eggs from





its thirteen annual monitor colonies in each of the Great Lakes and the connecting channels. The occurrence of deformities in young Double-crested Cormorants and pollution levels of nesting adults continued to be monitored.

As part of the Upper Great Lakes Connecting Channels Study, CWS has collected (and submitted for analysis) eggs of Herring Gulls, Black-crowned Night Herons and Forster's Terns from the Detroit, St. Clair and/or St. Mary's Rivers. This was repeated in 1986/87.

### Department of Fisheries and Oceans

#### Fish Contaminants Surveillance

Data for the 1984 Contaminants Surveillance Program was derived from whole fish contaminant burdens monitored at ten sites on the four Canadian Great Lakes. Lake trout, walleye or coho salmon were top predator fish species while rainbow smelt continued as the forage fish species indicator. Non-routine contaminants such as toxaphene, dioxin and chlorinated diphenyl ethers were monitored in selected top predator samples at suspected problem areas.

The contaminants effects monitoring program was expanded to define the incidence of skeletal anomalies, including fin ray asymmetry, backbone composition and vertebral column deformities, in populations of slimy sculpins and rainbow smelt throughout the basin.

#### Lake Trout Reproduction

Testicular anomalies were first reported in Lake Ontario trout in 1978. Investigations have been continuing since 1980 to determine the implications of testicular anomalies to lake trout reproduction, the geographic distribution of affected stocks, and the relationships between testicular anomalies and circulating levels of testosterone, 11-ketotestosterone, and gonadotropin. Affected testes were not associated with altered gonadosomatic indices, sperm count, sperm volume, or sperm motility. However preliminary evidence indicates that spermatozoa from affected fish are less viable than those from apparently normal lake trout.

Additional research is needed to confirm observations of reduced sperm viability and possible correlations with testicular levels of chlorinated hydrocarbons and trace metals.



### Fish Health Assessment

A 1983 tumor survey indicated that white suckers in Lake Ontario were affected with a benign lip papilloma. The frequency of occurrence ranged from background levels of less than 10 percent in the far western end of Lake Ontario (Hamilton Harbour). Papilloma frequency was age dependent and population prevalence was determined by combining data for fish older than 5 years of age.

In addition to lip papillomas, white suckers were also affected by vertebral anomalies (lordosis and scoliosis), skin lesions (papillomas and carcinomas), and liver lesions. Extensive surveys of white suckers from Oakville Creek and South Bay (control site on Manitoulin Island) in 1985 revealed several types of liver lesions including cholangiolar and hepatocellular carcinomas, hepatocellular adenoma, melanohistiocytoma, and granulomas (hepatic, peritoneal, and splenic).

### Hamilton Harbour - Status and Rehabilitation Potential

Historically, the warm water fishery in Hamilton Harbour consisted of pike, bass, yellow perch, sunfish, muskellunge, walleye, freshwater drum, channel catfish, brown bullhead, and white sucker. Pike and bass were the most important warmwater species in the Hamilton Harbour and Cootes Paradise fishery and contributed approximately 27,000 and 12,000 lbs. per year respectively to the recreational fishery in the 1870's. The outer harbour also supported a coldwater fishery dominated by lake trout, whitefish, and lake herring. Commercial records indicate that Hamilton Harbour produced 10,000, 30,000, and 250,000 lbs. per year of each species respectively in the late 1800's. By 1940, annual catches of trout, whitefish, and herring had declined to 0, 600, and 150 lbs. per year.

The Hamilton Harbour fishery declined rapidly in the early 1900's due to the combined effects of exploitation, deteriorating water quality, and lost littoral habitat. Fish kills were common along the industrialized south shore. Continued industrial expansion caused filling, and increased siltation. Elevated water levels resulted in reduced total marsh habitat available to warm water fish in Hamilton Harbour and Cootes Paradise from 1129 acres in 1789 to 280 acres in 1979. In addition, increased eutrophication resulted in depleted dissolved oxygen concentrations in the hypolimnion. This effectively eliminated the coldwater species from Hamilton Harbour and confined the warmwater fishery to the littoral zone during the summer months.





Efforts by the Ontario Ministry of the Environment to improve industrial and domestic discharges have resulted in substantially improved water quality. Recent surveys describing the biota of Hamilton Harbour indicate that there are more than 40 species of fish using the harbour at different times of the year. The fishery is dominated by alewife, white perch, brown bullhead, carp, white sucker, yellow perch, and gizzard shad. The harbour also supports a large population of sunfish and white crappies. Pike and bass, which dominated the recreational fishery in the late 1800's, are rare in Hamilton Harbour and Cootes Paradise although a small population of pike spawned in the mouth of Grindstone Creek in 1985.

A benthic survey conducted in 1964 was repeated in 1985. Results clearly indicate an improved benthic community. Although the benthos is still dominated by oligochaetes, there has been a change in species composition from the pollution tolerant Tubifex tubifex and Limnodrilus hoffmeisteri to the more sensitive Quistadrilus-multisetosus. A toxic zone reported in 1964 on the south shore had almost disappeared by 1985 and overall invertebrate biomass increased at least 5 fold.

A macrophyte survey conducted in 1985 indicated that submerged aquatic vegetation was sparse in Hamilton Harbour. Macrophytes are found along the north shore and in the southwest corner of the harbour. They occur only in sparse clumps in shallow water and are not found at depths greater than 2.5 meters. Similarly, macrophytes in Cootes Paradise have declined in abundance, distribution, and species richness. There were 24 macrophyte species reported in Cootes Paradise in 1949 and only 10 species in 1970. Loss of macrophytes has been attributed to fluctuating water levels, eutrophication, reduced light penetration, and uprooting by carp.

It is clear that research is needed to determine what factors were responsible for the loss of marsh habitat. Historic changes in the Cootes Paradise marsh and in three similar marshes on Lake Ontario are currently being quantified to determine if all marshes declined at the same rate and whether these changes are correlated with elevated water levels or changing land use. Efforts are also being directed at determining what habitat features are limiting pike and bass in Hamilton Harbour and encouraging carp and white perch populations.



### Dynamics and Physiological Ecology of Great Lakes Phytoplankton: A Monograph

This project deals with the synthesis of several years of lakewide phytoplankton data towards the preparation of a monograph. It focusses on phytoplankton community structure, productivity, and physiological ecology. It also emphasizes the assessment of contaminant toxicity to the productivity of natural size assemblages (ultraplankton, sicoplankton) grazed upon by zooplankton. This assessment is used as an early warning tool for the protection of fisheries resources. During 1985/86 the project dealt with the following:

1. A Lake Superior plankton status report for the I.J.C. provided a comparative analysis of 1973 to 1983 phytoplankton and zooplankton community changes.
2. Georgian Bay/North Channel phytoplankton community structure and physiological ecology.
3. Seasonality of phytoplankton in the North American Great Lakes.
4. Phytoplankton/zooplankton of Lake St. Clair.
5. Evaluation of plankton size spectra for fish stock assessment and yield prediction.

### Bioassessment of Sediment Associated Contaminants

This project represents DFO's continuing research with in-place pollutants. The research is designed to assess bioavailability and toxicity of contaminants, originating from bottom sediments and suspended particulates, to the edible food resource - ultraplankton. It also deals with the application of rapid micro-computer based toxicity testing of instant stress on ultraplankton. Major activities included the following:

1. Evaluation of dredging, dredge disposal, and navigational activities in Toronto Harbour in terms of bioavailability of in-place pollutants. Assessment of the impact of sewer outfalls from the City of Toronto on the harbour's primary productivity. This project was jointly supported by DFO, EPS, Toronto Harbour Commission and the Metropolitan Toronto Conservation Authority.



2. Bioassessment of Detroit River sediments.
3. Environmental impact of slag disposal at Port Dover, Lake Erie.
4. Bioavailability of phosphorus from tributaries draining into Lake Erie.
5. Application of micro-computer based video analysis system (VAS) for toxicity testing.

#### Bioindex Monitoring - Report

The seasonal physical and nutrient conditions in the open-water regions of Lake Ontario in 1984 were typical of preceding years. The temperature regime was similar to that in 1981 with seasonally weighted means (SWM) of 10.5C to 13.1C. The long term trend of increasing nitrate-nitrite levels reported by Stevens and Neilson (1986) was not evident in the SWM concentrations between 1981 and 1984. However increasing concentrations in the early spring (temperature 6C) were observed at 3 of the 4 stations. By the same criteria there was an increasing trend in early spring soluble reactive silica, but not in total Kjeldahl nitrogen, ammonia, total phosphorus or total filtered phosphorus. Caution should be exercised when describing "trends" over four years: these trends may not be real.

The chemical measures of biological activity, particulate organic carbon and nitrogen and dissolved organic carbon, showed no appreciable change from previous years. Chlorophyll a (uncorrected) however, was 20 to 30 percent lower in 1984 than in previous years, and the proportion of phaeopigments much higher, especially at stations 41 and 93. In spite of these changes, SWM total algal biomass was similar to previous years, ranging from 0.762 g.m-3 at station 41 to 1.050 g.m-3 at station 93. This suggests a shift in algal composition and more severe grazing pressure. In 1984 diatom biomass had decreased while Chrysophycean biomass had increased by 7 to 12 percent.

Bosmina longirostris and Diacyclops thomasi remained the dominant members of the zooplankton community suggesting that alewife continued to control community structure. The SWM zooplankton biomass ranged from 1234 g.m-2 at station 93 to 1996 g.m-2 at station 41. This was the highest biomass recorded at station 41, but the lowest or second lowest observed at the other stations. Production was also much higher at station 41 (66.7 g.m-2) and intermediate at





the other stations (37.9 g.m<sup>-2</sup>-station 12, 49.3 g.m<sup>-2</sup>-station 93) compared with previous years.

Mysid life history and production were determined at the deep water station, 41. Life history was similar to that in Lake Michigan with a maximum life span of two years and two reproductive periods in the latter year. The average November to April density was 420+/- 197 (SD) individuals.m<sup>-2</sup> and annual production was 2.2 g.m<sup>-2</sup>. Work is presently in progress investigating the inter-relationship amongst the various trophic levels including the planktivores.

Stevens, R.J.J. and M.A.T. Neilson. 1986. Response of Lake Ontario to reductions in phosphorus load: 1967-1982. Spec. Publ. Can. J. Fish. Aquatic Sci. (in press).

#### 4.3.2 ONTARIO PROGRAM

The surveillance program of the Province of Ontario conducted by the Ontario Ministry of the Environment under COA addresses water quality problems in the nearshore areas of the Great Lakes and their connecting waterways, including discharges, urban and agricultural drainages and shore-based construction activities. The Province's surveillance projects are listed in Table 2.

Information based on these activities is published in reports by the Ministry of the Environment and in scientific papers. Pertinent results from these studies are also summarized and submitted to the IJC Water Quality Board for inclusion in its Annual report to the International Joint Commission.

##### Lake Superior

Areas of Concern in the nearshore regions of Lake Superior studied by the Province in 1985 included Thunder Bay and Peninsula Harbour.

At Thunder Bay, changes in nearshore water quality as a result of remedial measures implemented since the 1983 water quality survey were assessed. Environmental conditions of the lower Kaministiquia River were examined in support of a Control Order review for the pulp and paper mill operation on the Kaministiquia River.



TABLE 2

PROVINCIAL SURVEILLANCE PROJECTS  
1985/86

ONTARIO MINISTRY OF THE ENVIRONMENT

LAKE SUPERIOR

Kaministiquia River/Thunder Bay Environmental Survey  
Peninsula Harbour Environmental Survey  
Lake Superior Intensive Year Studies Reporting

ST. MARYS RIVER

St. Mary's River: (a) Environmental Monitoring  
(b) Low Level Contaminants  
(c) Chemical Transport Modelling

LAKE HURON

Penetang-Midland-Sturgeon Bay Environmental Monitoring  
Severn Sound-Georgian Bay Physical Exchange

ST. CLAIR RIVER/DETROIT RIVER SYSTEM

St. Clair River Environmental Monitoring  
St. Clair River Chemical Transport and Fate Modelling  
St. Clair River-Sarnia Waterfront  
Lake St. Clair Sediment and Benthos  
Contaminant Inputs to St. Clair R., Lake St. Clair and Detroit R.  
St. Clair and Detroit River Biomonitoring  
St. Clair/Detroit River Trace Contaminants  
Detroit River-Bacteriological Studies

LAKE ERIE

Western Basin-Lake Erie  
Nanticoke Environmental Study-Long Term Water Quality Impact  
Assessment

NIAGARA RIVER

Upper and Lower Niagara River Water Quality  
Nearshore Cladophora Contaminant Monitoring-Lake Ontario and  
Niagara River





TABLE 2 (Cont'd)

LAKE ONTARIO

Hamilton Harbour

Oakville - Ford Plant

- Toronto Waterfront: a) Inventory of Contaminants Associated with  
Suspended Solids  
b) Seasonal Variaton in Bed Sediments  
c) Assessment of Sediment Transport  
d) Bacterial Loadings  
e) Bacteriological Quality at Beaches  
f) Macro Circulation Model  
g) Impacts of Lakefill Embayments on Nearshore  
Sediment Quality

Port Hope - Physical Circulation and Water Quality Assessment

Belleville - Bacteriological Status following STP Expansion

Kingston Harbour Bacteriological Survey

Bay of Quinte Study ("Project Quinte")

Bay of Quinte - Inorganic and Organic Compounds

St. Lawrence River - Maitland

St. Lawrence River - Cornwall/Massena Area

BASIN-WIDE STUDIES

Environmental Impacts of In-Place Pollutants in Sediments

- a) Chemistry of Sediments and Biota
- b) Sediment Toxicity
- c) Contaminant Fate

Seasonal Variation in Contaminant Body Burdens of  
Macroinvertebrates

Development and Standardization of Sediment Bioassessment  
Techniques

Great Lakes Dredging

Municipal and Industrial Discharge Assessments

Nearshore Young-of-the-Year Fish Contaminants Surveillance

Water Works Intake Monitoring Program

Enhanced Tributary Monitoring

Development of Instrumentation and Sampling Technology

SUPPORT ACTIVITIES

Data Management

Data Analysis

ONTARIO MINISTRY OF NATURAL RESOURCES

Inventory and Evaluation of Fish Habitat in the Great Lakes

Analysis, Evaluation and Integration of Data Bases



The effectiveness of a newly installed submerged diffuser outfall by James River pulp and paper mill at Marathon, Peninsula Harbour, was assessed by repeating the 1984 study which was conducted prior to its construction.

#### St. Mary's River and Lake Huron

Areas of Concern studied in 1985 included the St. Mary's River, the embayments characterizing the Severn Sound area (Penetang-Midland-Sturgeon Bays) and Collingwood Harbour.

The upper St. Mary's River was surveyed using large volume sampling and biological monitoring to define sources and significance of polycyclic aromatic hydrocarbons found along the Ontario shoreline during a preliminary 1984 study using freshwater caged clams. In addition, the sediment and benthos of the lower river were sampled to assess changes due to increases in river flow and remedial measures at Algoma Steel and St. Mary's Paper.

Sampling continued at long-term monitoring stations in the Severn Sound (Penetang-Midland-Sturgeon Bay) area to assess water quality changes as a result of reduced phosphorus loadings. Monitoring of Severn Sound has shown limited response to nutrient control and eutrophication potential remains. To better assess the limited response to phosphorus controls and to aid in the development of a comprehensive management plan for the area, the physical water exchange between Severn Sound and Georgian Bay was investigated.

Collingwood Harbour was chosen as the first Canadian Area of Concern for which a comprehensive Remedial Action Plan (RAP) was to be developed. The RAP concept was developed to help assess progress being made in Areas of Concern and includes detailed information on environmental problem definition, identification of impaired uses and sources, options for remedial measures and schedule for implementation and a long-term surveillance plan. The draft RAP, which was developed jointly with Environment Canada, was submitted to the IJC in March 1986.

#### St. Clair River, Detroit River and Lake Erie

The St. Clair River and Detroit River have both been identified to the IJC as Areas of Concern. Monitoring continued for contaminants in water and suspended sediments at the mouths of 12 tributaries to the St. Clair and Detroit Rivers to assess industrial inputs, with emphasis on the spring runoff period. Laboratory analyses of clam tissue samples collected during 1984 continued to assess



the significance of point-source discharges.

A survey of benthic fauna and surficial sediment quality was conducted in the St. Clair River to assess effectiveness of remedial measures undertaken by industrial dischargers. A fate model was developed and tested using a typical organic compound discharged into the river to discern concentrations in sediments, water and biota, and to assess the effectiveness of alternative chemical controls for industries.

Dow Chemical's spill of perchloroethylene into the St. Clair River near Sarnia in August 1985 led to additional surveys of water, sediment and biota by the province and the publication of a joint provincial/federal report on the pollution investigations, in January 1986.

A limited sediment survey in the Western Basin Lake Erie, as part of an Environment Canada project, was designed to determine the impact of the St. Clair/Detroit Rivers on Lake Erie.

The province participated in the binational Upper Great Lakes Connecting Channels (UGLCC) Study through the activities in the St. Mary's, Detroit and St. Clair Rivers and Western Basin Lake Erie noted above.

#### Niagara River, Lake Ontario and St. Lawrence River

Identified Areas of Concern in Lake Ontario include Niagara River, Hamilton Harbour, Toronto Waterfront, Port Hope, Bay of Quinte and Cornwall in the St. Lawrence River.

Assessment continued on 1983 surveys (water, sediment, benthos, clams) conducted in the Niagara River to determine the impact of U.S. and Canadian industrial and municipal discharges and non-point source drainage on river water quality and biota and to detect trends in trace contaminants, nutrient and bacteria levels. Cladophora at nineteen sites in the Niagara River and Lake Ontario were monitored for contaminant uptake levels including trends for nutrients, heavy metals and PCBs.

The Hamilton Harbour management report was released in August 1985. Management options to be assessed include those allowing further water quality deterioration, maintenance of existing quality, and improvement in water quality. The management strategy is being developed in cooperation with the municipality and local agencies to restore and protect the desired uses for the harbour,





identified through a Public Involvement Program in 1986.

Assistance was provided to the City of Toronto in monitoring of bacterial water quality at major point sources and at Lake Ontario/Toronto area beaches. Major river and STP inputs were surveyed (centrifuged particulate and sediment trap samples) to provide a contaminant inventory and a means of ranking suspended solids associated contaminants at various inputs across the Toronto waterfront. Although the impact of suspended solids inputs on water quality tends to be localized, the potential exists for impacts on area sediment quality. Reporting commenced on 1984 surveys in the vicinity of the East Headland to assess the potential interference of dredging/lakefilling activities and on surveys of embayments created by lakefills to determine impact on inshore water quality, sediments and benthic organisms.

Current metering, drogue tracking and limited water chemistry sampling were undertaken in Port Hope Harbour and the Ganaraska River mouth to study the potential impact of river/harbour discharges on the water intakes.

The nearshore of Bay of Quinte at Belleville and the Moira River was re-surveyed to assess the effectiveness of a new diffuser outfall installed at the Belleville STP and to locate sources of additional bacteriological degradation in the Bay of Quinte and Moira River. The 1984 survey which examined the effect of the earlier STP expansion, indicated little improvement in bacteriological quality under runoff conditions.

For a number of years, beaches in the Kingston Harbour area, which is used extensively for recreational purposes, have been closed regularly due to bacteriological contamination. The problem is believed to be caused by about 12 combined sewer outflows, which discharge to the lower Cataraqui River and Lake Ontario. The province conducted a bacteriological survey to define sources of impairment in Kingston Harbour and to develop recommendations for control.

A reduced monitoring program continues in the Bay of Quinte to assess the long-term effects of municipal phosphorus loading reductions. Although a number of steps have been taken to improve municipal treatment facilities, and phosphorus removal is on-line at all municipal plants. Phytoplankton densities have recently increased to levels approaching some of the pre-phosphorus control years.



Assessment commenced on 1984 surveys in the St. Lawrence River at Maitland to determine the impact of industrial discharges on river water, sediment quality and biota. Previously, elevated levels of lead had been found in sediments downstream of the Dupont outfall and in fish caught near the outfall. Subsequent to the province's survey, Dupont Canada's tetraethyl lead plant announced that it was ceasing operation at the end of June, 1985.

Surficial bottom sediments and benthic fauna in the Cornwall/Massena area were surveyed and assessed to determine the presence and extent of biological impairment and sediment contamination due to industrial and municipal discharges to the St. Lawrence River. Present data indicate contamination of sediments by PCBs and heavy metals, and elevated concentrations of these pollutants in some industrial effluent, river and tributary water samples. The effectiveness of remedial measures undertaken by Domtar on levels of phenolics and bacteria in river water was also investigated.

#### Basin-Wide Provincial Great Lakes Programs

The province maintained a number of basin-wide monitoring and investigative programs in support of the Great Lakes Water Quality Agreement.

- ° The assessment of the potential hazards of selected contaminants in sediments (in-place pollutants) on water quality and biota at some of the Areas of Concern (Toronto Waterfront, Hamilton Harbour, St. Mary's River, Niagara River and St. Clair and Detroit Rivers, Wheatley Harbour) was continued.
- ° The toxicity of contaminated sediments from selected industrial areas throughout the Great Lakes, on the aquatic biota was assessed through bioassay studies.
- ° A review of world literature commenced to update dredged material disposal guidelines.
- ° Collections of young-of-the-year spottail shiners were taken from 42 localities throughout the Great Lakes for point-source identifications, assessment of effectiveness of remedial measures and temporal trend assessment.
- ° Nutrient and contaminant loadings for 17 significant tributaries to the Great Lakes were estimated.
- ° The assessment of the effectiveness of phosphorus control





programs continues through the long-term sampling of raw water from 18 municipal intakes.

- ° Assessment commenced on the interrelation of fishery data bases with water quality and community structure to measure whole lake responses to pollution and pollution control.
- ° Identification of criteria to determine critical fish habitats to design protection and surveillance programs.

#### 4.4 Toxic Substances Committee

Due to unforeseen workloads and the resignation of the federal co-chairman, the Toxic Substances Committee did not formally meet during 1985-86. However, key issues of interest to the Committee, toxaphene and alkyl lead, were pursued.

The Ministry of the Environment continued to test for toxaphene residues in fish flesh through its routine sport fish testing program. Concentrations are well below levels that would trigger fish consumption limitations, however, low levels were measured at several locations in Ontario including remote inland lakes. This finding suggests past deposition from atmospheric sources may be a contributing factor.

Severe toxaphene use restrictions (virtual use elimination) have been in place in Ontario for many years and limits were placed on uses within the United States in recent years. Sufficient data have not yet been accumulated to show trends in fish tissue residues as a result of the U.S. action.

The tetraethyl lead plant located on the St. Lawrence River at Maitland began its final shut-down during 1985. With the elimination of active alkyl lead discharges from this source, it is expected that levels of lead in fish living in the vicinity of the discharge will decline. In 1985, the Ontario Government in its Guide To Eating Ontario Sport Fish published consumption advice for anglers fishing in the vicinity of Maitland. It essentially recommended limited consumption for all fish caught in the Blue Church Bay area. This advisory was repeated in the 1986 Guide. Testing will take place in the fall of 1986 to determine if lead levels have indeed declined and consumption advice for 1987 can be altered.

#### 4.5 Pollution Controls Committee

The Committee provided data on municipal and industrial point source discharges for 1984 to the Water Quality Board's Office in Windsor. A tape of the raw inventory data was submitted to the IJC in early 1986.



The Committee coordinated, with the Surveillance Committee, the preparation of a model RAP for Collingwood Harbour. The Collingwood RAP was submitted to the Board for review.

The Committee coordinated the preparation of projects under the Phosphorus Management Plan.

#### 4.6 Public Information Committee

Displays produced by the Public Information Committee were used at the International Joint Commission (IJC) meeting in Kingston, Ontario and in a variety of other public forums throughout the year. A script for a play on Great Lakes pollution was produced for presentation at similar public events in the following year.

An education program consisting of a puppet show, computer program and education kit was designed by the Committee to sensitize young students to the problems of pollution in the Great Lake Basin. The puppet show was well received in schools and libraries throughout the Great Lakes Basin. The computer game, which teaches the effects of phosphorus nitrogen on lakes, was prepared for distribution directly through the Ministry of Education. The education kit will be distributed to schools and special interest teachers during the following fiscal year.

The Public Information Committee was also involved in four sewage treatment plant openings in the Great Lakes Basin. News releases were issued to mark the transfer of federal funds to the Province for the improvement of sewage treatment facilities.

#### 4.7 Polluted Sediment Committee

The Polluted Sediments Committee was established in 1985/86. After developing a terms of reference, the Committee's first task was to identify knowledge gaps pertaining to the characterization of sediment quality. This began with the re-evaluation of the Ministry of Environment's Open Water Disposal Guidelines. These guidelines are used by both the federal and provincial governments for project reviews. The guidelines' overall philosophy was scrutinized (i.e., the appropriateness of bulk chemical characterization) as were the specific parameters and associated acceptable levels. Based on this preliminary work several issues were identified.

- ° Natural background levels of some parameters may exceed the guidelines, it is therefore necessary to review projects on a case-by-case basis rather than using "blanket guidelines".
- ° There is a need for standardized sampling methodologies in order to permit data comparisons.



- ° Sequential fractionation is useful for the provision of information on the potential availability of a contaminant whereas bulk chemical methodologies do not permit differentiation between what is and is not accessible to the water column.
- ° Bioassessment techniques are a sophisticated method of evaluating sediment quality and should be given serious consideration.

In order to address these issues various projects and contracts were initiated by the Committee. A contract for the development of sampling protocols was completed. The guide is designed to assist a project co-ordinator in obtaining an accurate representation of sediment quality. A second contract was issued for a literature search which provided background information on various analytical methods for sediment quality including the elutriate test, sequential fractionation and bioassessment. In house, a bioassessment methodology was developed and field tested resulting in the development of an accurate, replicable technique which will be used in 1986 field studies in various Areas of Concern.

Through the initiation of these contracts and studies the Working Group has been able to better define the implications of in-place pollutant problems and identify critical issues pertaining to their evaluation and remediation in areas of concern.

#### 4.8 Environmental Monitoring and Modelling Committee

This Committee was established by COA Review Board to oversee implementation of the Phosphorus Load Reduction Plan. Terms of Reference for the Committee were set at its October 23, 1985 initial meeting. A technical sub-committee was established to develop a work plan and co-ordinate the initiation of monitoring activities.

Specifically, plans were made for the monitoring of water quality and quantity at the outlets of six Pilot Demonstration Watersheds which will be established by Agriculture Canada as part of the Southwestern Ontario Soil and Water Quality Enhancement Program. This program seeks to reduce phosphorus loading by 200 tonnes/year in the Lake Erie Basin by addressing agricultural non-point sources.

A modelling task group was also established by the EMMC technical sub-committee to evaluate modelling strategy which may be utilized to evaluate the effectiveness of the non-point source program in terms of basin-wide phosphorus loading reduction.





#### 4.8.1 Progress Report On Phosphorus Removal Efficiency Upgrading At Municipal STP's in the Great Lakes Basin

##### Achievements

- ° Phase 1 - "Assessment of STP Historical Performance on Total Phosphorus (TP), BOD and solids Removal" was completed.
- ° Study Results were reviewed by the Liaison Committee and an interim report is being sent by the consultant to the Committee for review.
- ° Major Observations made during Phase I are summarized as follows.
  - 1984 and 1985 data on TP removal indicate that should MOE change its compliance criteria from meeting TP concentration of 1 mg/l or less on an annual average basis to a monthly average basis, percent STP's in compliance with MOE objective for TP removal will drop significantly from about 85% to 15% on the Lake Erie Basin and from 80% to 30% on Lake Ontario Basin.
  - The consultant has examined the effectiveness of 7 different management strategies for controlling the total annual loadings of TP up to 1990 to Lake Ontario and Lake Erie at the 1983 level.
  - Detailed on-site studies (Phase 2) will be made of twelve sewage treatment plants which either consistently fail to comply or out-perform the compliance limit contained in the agreement.

##### Current Activities

- ° Identify the best management strategy for controlling the annual loadings of TP up to 1990 to the same level as in 1983.
- ° Carry out detailed on-site studies to identify critical factors affecting the removal of TP at 5 STP's that consistently out performed the compliance limit of 1 mg/l and at 7 STP's that consistently failed to meet the limit. Studies had been completed in 4 STP's. Studies will be completed in 3 more STP's by the end of July, 1986.



#### 4.9 Sewerage Facilities Construction Program

Under the 1972 and 1978 Canada-U.S. GLWQA (Article VI, Section 1(a)) Canada was obligated to aid Ontario and its municipalities in the upgrading or construction of sewerage treatment facilities, to meet the effluent objective of 1 mg of phosphorus/litre of discharge.

From 1971 to 1980, Canada's contribution was provided by CMHC (National Housing Act, Section 7) under several municipal infrastructure grants. As a fiscal restraint measure, this program was cancelled in 1980. The 1982 COA provided for a one-time federal contribution of \$65.0 million (pursuant to the Canada Water Act) to Ontario for the completion this program.

Due to labour strikes, equipment delivery delays and other factors beyond the control of the Federal and Provincial governments, municipalities were unable to utilize the full allocation of funds. Consequently, the new COA extends this program to March 31, 1987.

During 1985/86 the federal contribution for sewerage facilities construction was \$3,120,000. The make-up of this contribution is illustrated in Table 3. Since 1982, the federal contribution to this program has been \$58,334,631.

TABLE 3

Federal Contribution by Type of Work-Payment Year 1985/86

<u>TYPE</u>	<u>TOTAL \$</u>
Sewage Treatment Plant	1,980,718
Sewage Pumping Station	1,069,635
Sewers	69,647
	<u>\$3,120,000</u>

#### 5.0 1985/86 BUDGET

Funds expended under the 1985 COA derive from two sources, via., (1) the sum of \$3,394,000 as set out in Article VII of the Agreement, and (2) the sum of \$9,785,369.00 as set out in Section 4 of Schedule G, "Sewerage Facilities Construction Program".





Funds available from Article VII:

These funds support the cost-shared activities of Canada and Ontario under the Agreement and were applied as follows:

	<u>TOTAL</u>	<u>COST TO EACH PARTY</u>
Public Information	\$ 97,000	\$ 48,500
Surveillance	3,103,000	1,551,500
Implementation of the Canadian Federal/Provincial Phosphorus Management Plan	<u>194,000</u>	<u>97,000</u>
	<u>\$3,394,000</u>	<u>\$1,697,000</u>

Section 4, Schedule G, Sewerage Construction Program:

This is the continuation of the program initiated in 1982 which provides a one time Federal contribution to the Province of \$65,000,000 to complete municipal sewerage facilities construction projects in accordance with the Canada-U.S. Great Lakes water Quality agreement. Contributions available to the Province for transfer to eligible municipalities in FY 1985/86 amounted to \$3,120,000. This leaves an unspent balance of \$6,665,369 from the amount available. )

6.0 SPECIAL PROJECTS

6.1 Niagara River Toxics Committee

Since the public release of the Canada-U.S. Niagara River Toxics Committee (NRTC) report in November, 1984 and in accordance with the responses of the participating jurisdictions to the NRTC recommendations (at various times during 1985) the U.S. EPA, New York State DEC, Ontario MOE and Environment Canada have continued working to develop a Niagara River Toxics Management Plan. The objective of the Plan is to reduce loadings of toxic chemicals to the Niagara River in accordance with a timetable and a set of specific activities.

The preliminary framework of a Niagara River Toxics Management Plan was developed by the four agencies by March 1986.

In the meantime, agencies are continuing with their individual remedial actions identified in their responses to the recommendations of the NRTC.

6.2 Upper Great Lakes Connecting Channels

The St. Mary's, St. Clair and Detroit Rivers were designated as Class A areas of concern by the International Joint Commission



in 1981. This was based on evidence of significant environmental degradation and severe impairment of beneficial uses. Although water quality in these areas has improved, persistent pollutants such as heavy metals, organochlorine pesticides and PCBs remain in the fish, sediment and water.

In his November 1983 speech to the IJC meeting in Indianapolis, Indiana, the U.S. Environmental protection Agency Administrator William Ruckelshaus announced a U.S. study on the St. Mary's, St. Clair and Detroit Rivers, including Lake St. Clair, and invited Canadian support. By February 1984, the State of Michigan, Environment Canada, Department of Fisheries and Oceans, and the Ontario Ministry of the Environment had all agreed to merge their ongoing studies and develop new programs in conjunction with the U.S. agencies.

The Purpose of the study is:

- ° to facilitate the development of remedial action plans; and
- ° develop a framework for understanding ecosystem-contaminant dynamics for these waterbodies.

A three-tiered management structure was formed: the Management Committee, the Activity Integration Committee and the Study Work Groups.

The responsibility of the Management Committee is to identify the issues and define the study structure, approve the study work plans, and approve the final study report for submittal to the participating agencies.

The Activity Integration Committee (AIC) consists of the chairmen of the technical work groups plus representatives of U.S. and Canadian federal and regional governments. It is responsible for preparing and overseeing implementation of the study work plan and the drafting of the final study report.

Members of the work groups are scientific technical experts from participating governmental agencies. They have major responsibilities for identifying, planning and coordinating the surveillance and research activities.

The progress of the UGLCCS has been reviewed by COA at each meeting since the inception of the study. The notable achievements in 1985/86 are identified below:

- ° The UGLCCS has completed this first field season and is beginning the second and final field season. The seven technical work groups - Biota, Modelling, Non-Point Source,



Point Source, Quality Management, sediment and Water Quality - developed and executed their work plans for 1985.

- ° A mid-course workshop was held in Taylor, Michigan in February, 1986 to evaluate the progress to date and to plan for the 1986 field season. The workshop was hosted by EPA's Large Lakes Research Station at Gross Isle and conducted by the members of the AIC.
- ° The workshop indicated in general that the original goals and objectives of the study were reasonable and that the 1985 Work Plan of Activities adequately addressed those objectives. No major gaps were perceived in either the activities or the funding of these activities.
- ° DOE and MOE reacted to the spill from Dow Chemical by conducting an exhaustive study on the cause and effect of the spill. The results contained in the report were reviewed by the Work Groups. As a result, substantial changes were made to the 1986 Work Plan of Activities, particularly for the Water quality Work Groups.





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